(1)

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Subject ; Hydraulic-Structure

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Question No: 1

(a) Differentiate between culvert and causeway?

Ans **Culvert;**

A culvert is a structure that allows water to flow under a road, rail road trail or similar obstruction from one side to other.

* **Causeway;**

A causeway is of coarse a raised road usually built on embankment after running across water or swampy land.

* Difference b/w Culvert and Causeway

Culvert	Causeway
* Culvert is a transverse channel under road or railway for the draining of water	Causway is a road that is raised as to above water and marshland etc
* It works as a bridge to pass on river or Stream	It is not a bridge because it supports a roadway between piers.
*	

Question NO: 1

(B) Cross Drainage work;

Cross drainage work is a structure constructed where there is a crossing of canal and natural drain to prevent the drain water from mixing into the canal water. By mixing two or three streams into one and only one cross drainage work to be constructed making the structure economically.

* Necessasity of Cross drainage work;

The cross drainage work is required to despose of the drainage water. So that the canal supply remains uninterrupted. A cross drainage work is also called drainage crossing. The canal at a cross drainage work is generally taken either Over or below the drainage.

Question No; 01

(B) Types of cross drainage work.

* Type I; Irrigation canal passes over the Drainage.

* Aqueduct; The hydraulic structure in which the irrigation canal is taken over the drainage (Such as river or stream) is known as aqueduct. This structure is suitable when bed level of canal is above the highest flood level of drainage.

* Siphon Aqueduct; In a hydraulic where the canal is taken over the drainage. But the drainage water cannot pass clearly below the canal. It flows under siphon action. So it is known as siphone aqueduct.

Question NO: 01

(B) Type: II ; Drainage passes over the irrigation canal

* **Super passage;** The hydraulic structure in which the drainage is taken over the irrigation canal is known as super passage. The structure is suitable when the bed level of drainage is above the the full supply level of the canal.

* **Siphone super passage;** The hydraulic structure in which the drainage is taken over the irrigation canal but the canal water passes below the drainage under siphon action is known as super siphon passage

Question No: 01

Type III ; Drainage and canal intersect each other at the same level.

Level crossing;

When the bed level of canal and stream level are approximately the same and quality of water in canal and stream is not much different the cross drainage work is constructed is called level crossing. Where water of canal and stream mixed with each other.

Inlet and Outlet;

When irrigation canal meets a small stream or drain at same level drain is allowed to enter the canal as in inlet. At some distance from inlet point a part of water is allowed to drain as outlet is called Inlet Outlet cross drainage work.

Question Number (02)

(a) **Difference Between weir and Barrage.**

* A weir is a concrete or masonary structure is constructed across open channel to change its water flow characteristics.

* A Barrage is a special type of dam which consist of a line of large gates that can be opened or closed to control the amount of water passing the dam.

* A weir is an ~~im~~ ~~less~~ able impermeable barrier that is built across river to raise water level at upstream side.

* Barrage is consist of different adjustable gates to maintain the water level.

Question NO: (02).

* Barrage are built near the cities so that the amount of water flowing in the river can be controlled by openning and closing the gates

* While weir is construct near to that area where the tourist tour to that area preservative areas to allow the fish into swim upstream.

Question NO: 02

(B) **Reynold Number;** It is the ratio of inertial force to the viscous force is called Reynold Number.

$$Re = \frac{\rho V L}{\mu}$$

* When (Re) reynold numbers. $Re \leq 2000$ Such type of flow is called laminar flow.

* When the value of reynold numbers in between 2000 and 4000 ($2000 < Re < 4000$) such type of flow is called transition flow.

* When the value of reynold numbers is greater than 4000 ($Re > 4000$) such type of flow is called Turbulent flow.

Question NO: 02

* **Lower critical velocity;**

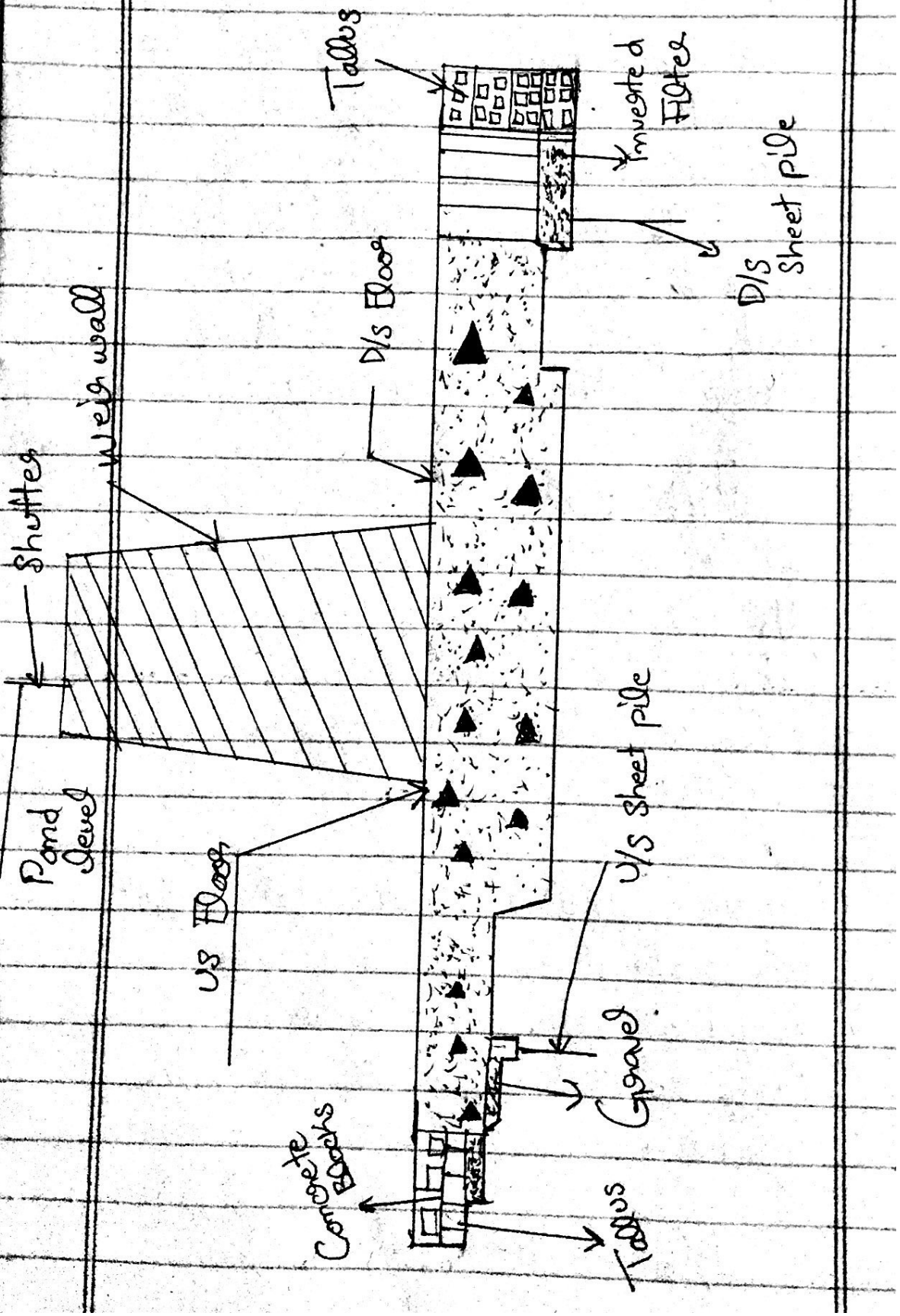
When Froud number $Fr < 1$ then such type of flow is called lower critical flow in this case critical depth is lower than scour depth $y_c > y$ and $V > V_c$ while velocity is lower critical velocity.

* **Higher critical velocity;**

When Froud number $Fr > 1$ then such flow is called higher critical flow at this point critical depth is greater than scour depth $y_c > y$ and velocity is called high critical velocity.

Question No: 3

(a) Sketch of Barrage.



Question NO: 3

(B) Scour around bridge pier:

Several formulae based on experimental result have been proposed to predict the maximum or equilibrium scour depth (y_s, below general bed level) around bridge pier. In general these assume the relationship.

$$y_s/b' = \phi(y_o/b', Fr, d/b')$$

where b' is the pier width
y_o is the upstream flow depth
d is the sediment size and
Fr is the flow froud numbes.

Laursen's (1962) experimental results underestimated the scour depth compared to many indian experiments (Inglis 1949) which suggest the formula

$$y_s/b' = 4.2(y_o/b')^{0.78} Fr^{0.52}$$

Question (03)

(B) The indian field data also suggest that the scour depth should be taken as twice the regime scour depth.

In case of live beds (a stream with bed load transport) the formula.

$$y_s/y_o = (B/b')^{5/7} - 1$$

equillibrium.

Predict the maximum scour depth

Question NO: (04)

* **Given data**

Dimension = 15 X 15

L.L = 1.5 kip/ft² = 1500 lb/ft².

D.L = 300 lb/ft²

unit wt of soil = 100 lb/ft²

For 1:2:4 = M15 (Strength).

$\theta = 30^\circ$ Fy = 60 Ksi

Required data

Design Box culvert = ?

Solution

* **Load calculation;**

* Total load carrying on top slab = 0.92 X 15

= 13.8

* Total load = Live load + Dead load + 13.8

= 1500 + 300 + 13.8

= 1813.8 lb/ft².

* Coefficient of earth pressure;

$$Ka = \frac{1-\sin\phi}{1+\sin\phi} = \frac{1-\sin 30}{1+\sin 30} = 0.33$$

(i) Lateral pressure due to (L.L + D.L) = Total vertical load x Ka.

= 1800 x 0.33

= 594 lb/ft²

(ii) Lateral pressure due to Soil = Ka x γ x h.

= 0.33 x 15.92 x 100.

= 525 lb/ft²

(iii) Lateral pressure at top = Lateral pressure due to (D.L + L.L)

= 594 lb/ft²

Bottom = Lateral pressure due to (D.L + L.L) + Lateral pressure due to Soil

= 594 + 525.

= 1119 lb/ft²